

## An ethnobotanical survey of medicinal plants used by ethnic people in West and South district of Tripura, India

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**Abstract:** An ethno-medicinal investigation was conducted to highlights the traditional knowledge of medicinal plants being used by the tribe in West and South district of Tripura. This paper provides information about the different uses of plants used in their primary health care system. Tripura is a small north-eastern state of India and also a part of both Himalayan and Indo-Burma biodiversity region. It is a goldmine of medicinal plants and use of different plants in tribal traditional heath care systems has long history. Nineteen different tribes in Tripura, depend on natural resources at a great extent. This paper documented 113 medicinal plant species from 56 families along with their botanical name, local name, family name, habit, medicinal parts used, and traditional usage of application. The dominant families are Euphorbiaceae (7 species), Apocynaceae (6 species), Fabaceae and Rubiaceae (5 species each), Caesalpiniaceae, Asteraceae, Liliaceae and Verbenaceae (4 species each), Combretaceae, Labiateae, Malvaceae, Rutaceae and Zingiberaceae (3 species each). Tribes of Tripura have rich traditional knowledge on plant based medicine. Different parts of the plants in crude form/plant extracts/decoctions/infusion or pastes are employed in diverse veterinary and human diseases by the tribe's of Tripura in daily life.

**Keyword:** Tripura; tribes; traditional heath care system; medicinal plants

### Introduction

Herbs are staging a comeback and utilization of herbal medicines

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is increasing all over the world. In spite of tremendous advances in synthetic drugs and medicine, a large number of people still believe on herbal drugs with hope of safety and efficacy (Sandberg et al. 2001; Peter 2004; Salim et al. 2008). Herbal remedies used by ethnic people were generally effective, although they contained many inert compounds in addition to the active compound (s) (Kamboj 2000; Sannomiya et al. 2007; Verma et al. 2008). Among the world's 12 biodiversity centers, India is one of the important biodiversity hotspots with the presence of over 45 000 different plant species. The forest of India is the principal source of large number of medicinal and aromatic plants. It is estimated that there are more than 20 000 plants having good medicinal values, but only 7 000–7 500 species are used by traditional communities (Matthews 2005; Mao et al. 2009). Near about 700 species and 8 000 herbal remedies were described in Ayurveda. Rigveda (5000 BC) has codified 67 medicinal plants; Yajurveda, Atharvaveda (4500–2500 BC), Charak Samhita (700 BC) and Sushrut Samhita (200 BC) had described 81, 290, 1 100 and 1 270 species respectively with their usages in healthcare. Unani, Siddha, Amchi system also prescribes 700 600 and 600 plant species respectively. Still Ayurveda, Siddha, Unani and folk (tribal) medicines are the major sources of indigenous medicines (Joy et al. 1998; Ahmad et al. 2006; Samy et al. 2008). The ethnobotanical lore has not been sufficiently explored till now and there are a lot of unknown plant species whose medicinal values are still not reviled.

Tripura is a landlocked small hilly state of north-eastern India with the richest reservoir of plant diversity. Among the total area of 10 492 km<sup>2</sup> currently state has 59.98% of forest area, from which 34.2% is reserve forest, 4.85% is the proposed reserve forest and 20.93% is unclassified forest. Forest covers an area of about 6 292.681 km<sup>2</sup> with 379 species of trees, 320 shrubs, 581 herbs, 165 climbers, 16 climbing shrubs, 35 ferns and 45 epiphytes. Statistics also showed that state Tripura has maximum plant diversity index for 5.23 in India (Kshirsagar et al. 2009). Tripura is a part of both Himalayan and Indo-Burma biodiversity region, and availability of large number of flora and fauna made this region a 'biodiversity hotspot' (Dutta et al. 2005). Geographical area of the state is 0.3% of the country's geographical

area but its plant species consists 12.78% of the plant resources in the country (Kshirsagar et al. 2009). Tripura has tropical climate with the annual rainfall of about 2100 mm and temperature ranging between 10–35°C, with altitudes varying from 15 to 940 m above sea level. High humidity and low temperature accompanied by good rainfall make Tripura a unique treasure house of medicinal plants. Tripura has total population of about  $32 \times 10^4$  with a density of 304 persons per square kilometer according to the census of 2001. Among them, 69% are bengalis and tribal populations represent rest 31% (Lahiri 2007). Main language of the state is bengali and kokborak. The tribal population comprises several different tribes and ethnic groups with diverse languages and cultures. There are about 19 ethnic groups like Tripuri, Jamatia, Reang, Noatia, Chakma, Bhil, Bhutia, Chaimal, Garo, Halam, Khasia, Kuki, Lepcha, Lushai Mag, Munda, Kaur, Orang, Santhal and Uchai. Among them, Tripuri and Reang are the major groups (Dutta et al. 2005). Around 19 prominent hills of the state clogged with the different tribal communities, and some of them are still living in and around the dense forests. Indigenous people possess an immense knowledge of their environments and also depend on local flora and fauna for the food, shelter, ritual and healthcare. The tribal people on natural habitats hold incredible traditional knowledge on the use of various plant/forest resources (Rana et al. 2010; De et al. 2010). This traditional knowledge is based on their requirements, instinct, observation, trial and error and long experience. The use of medicinal plants plays a very vital role in the tribal society of Tripura for their health care. Our previous study has reported the impact of environment and biodiversity on tribal life of Tripura, India (De et al. 2010). It has shown that pollution from industrialization causes destruction of forest and plant species. With rapidly civilization, change in lifestyle of tribal people gradually results in declining their traditional sensation. Therefore, there is a need of documentation for preserving and exploring the therapeutic activity of traditional medicinal plants.

Different ethno-medicinal surveys were conducted by different researches (Shil et al. 2009; Singh et al. 1997; Majumdar et al. 2006; Majumdar et al. 2007; Das et al. 2009; Das et al. 2010). But no survey was conducted in the west and south Tripura districts to report the medicinal plant of used by the tribal people. Therefore in this present study, an ethnobotanical survey was conducted on two districts (West and South Tripura) of Tripura, India for investigating different plant sources used by different tribes in healthcare system and documenting traditional usages of different folk medicines used by the ethnic people of Tripura, India.

## Methods

### Study area

Tripura is situated in the bio-geographic zone of 9B-North-East Hills and lies between 22°56' to 24°32' N latitude and 90°09' to 92°20' E longitude. Tripura is adjacent to the Bangladesh, and its geographical limits touch both international and national bounda-

ries. The length of international boundary between Tripura and Bangladesh is 839 km in north, west and south-east periphery of Tripura, while the national boundaries with Assam and Mizoram are 53 km and 109 km respectively in east periphery of the Tripura (Majumdar et al. 2006). Survey was conducted in different tribal villages located in forests or in rural area of West Tripura and South Tripura districts out of four districts of Tripura. West Tripura district is situated approximately between north latitude 23°16' to 24°14' and east longitude 91°09' to 91°47'. whereas South Tripura district lies approximately between east longitude 91°18' and 91°59' and between north latitude 22°56' and 23°45'. Total geographical area of West and South Tripura district consists of 3 544 km<sup>2</sup> and 2 624 km<sup>2</sup> respectively. West Tripura and South Tripura comprise five subdivisions each and consist about 60% of total land of Tripura. All the tribes described above are also live in the remote areas and forests of the two districts. Periphery of West and South Tripura districts is bounded by Bangladesh on the north, west and south, and Dhalai district of Tripura on east.

### Investigating methods

Study has been carried out in several time intervals during the period 2007–2009 in different tribal villages located in West and South of Tripura district. Information on medicinal plants was collected from different tribal villages.

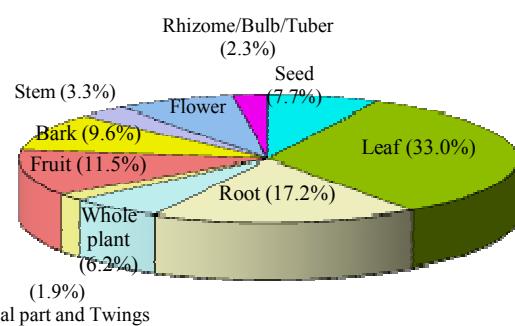
At first phase, using different flora books, a list of different species was drafted and accompanied by photos and drawings. Ethnomedicinal information on folk medicinal plants was collected through interviewing local informants. The local informants were medicine-men, men and women above the age of 50 years. A brief group discussion was made with the local informants at each village/area prior to ethnobotanical data collection to get their consent and to explain to them that their cooperation is a valuable contribution to the documentation of the traditional medicinal plants in the West and South Tripura. Semi-structured interview, group discussion, and field observation were used to collect data on knowledge and management of medicinal plants. The interviews and discussions were carried out in the local language because the author is a native speaker of the language. Information about the local names of the plants, the plant parts used, method of preparation and medicinal uses was collected in different tribal villages. Each locality was visited several times in different seasons to determine the authenticity of information collected during field work. Thus, only the specific and reliable information cross-checked with informants has been incorporated in the present study. All plant specimens were collected during different seasons (i.e. during flowering and fruiting period). Corrected identification of different plants was carried out with the help of forest guards, traditional medical practitioner (locally known as auchai, kabiraj or vaidyas) and knowledgeable persons. Samples of medicinal plants were collected for scientific identification and herbarium was prepared. The plant species were authenticated from the Department of Pharmacognosy, Regional Institute of Pharmaceutical Science and Technology, Agartala, Tripura. The plants were identified by the professional

experts and scientific names of plant species were recorded from reputed flora and books (Anonymous 1985; Deb 1989; Jain et al. 1991; Kritikar et al. 2005).

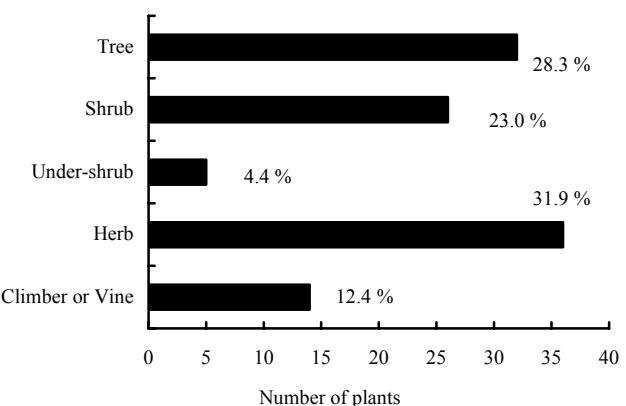
## Results and discussion

This paper was documented 113 medicinal plants from 56 families (Appendix 1). The plants are used to treat more than 50 different diseases, some of them are quite common like cold, cough, wound healing, pain and inflammation and different species of plant are used daily. Some of the plant like *Alocasia indica*, *Alternanthera philoxeroides* and *Azadirachta indica*, *Centella asiatica*, *Momordica charantia* are used in daily life as food; *Allium sativum*, *Curcuma longa* and *Cinnamomum tamala* are used as spice; fruits of *Aegle marmelos*, *Musa acuminate*, *Citrus lemon*, *Psidium guajava* and *Averrhoa carambola* are also common source of food. The prominent families include Euphorbiaceae (7 species); Apocynaceae (6 species); Fabaceae and Rubiaceae (5 species each), Caesalpiniaceae, Asteraceae, Liliaceae and Verbenaceae (4 species each), Combretaceae, Labiateae, Malvaceae, Rutaceae and Zingiberaceae (3 species each). Study reviled that percentage of leaf as raw materials for drugs is 33%, root 17.2% and fruits 11.5% among different plants (Fig. 1). The recorded ethnobotanical species were distributed over various life forms, of which 31.9% were herb, 28.3% were tree, 23.0% were shrub, 12.4% were climber or vine, and 4.4% were under-shrub (Fig. 2).

This study indicates that the ethnic people of West and South district of Tripura have acquired considerable knowledge about the medicinal uses of plants in their surroundings, and in their daily life to remain healthy. Different plant parts of these species, such as leaf, stem, bark, fruit, seed, root, tuber and latex were used in different forms like crude, powder, juice, decoction, infusion and paste for management of various ailments as medicine. The drug usages are generally taken by orally. Traditional modes of administration of folk lore by the different tribes of Tripura are tabulated in Appendix 2. Many of theses plant species and their parts are used as vegetable, spice and fruit in daily life by the people of Tripura, which also provide nutrition, supply minerals and may confer beneficial effect to remain healthy. During the survey, we observed that different tribes of Tripura still living on hills and forest still believe on traditional herbal medicines fully. Though pharmacological activities of several plants have been investigated and some of them are already incorporated in modern medicinal system based upon the traditional knowledge, we found that many of those traditional medicinal plants used by the tribes of Tripura are still a large untapped source of structurally novel compounds that might serve as lead for the development of novel drugs and have great potential to be developed as standard preparation for different disorders.



**Fig. 1 Utilization of aboveground plant parts of the medicinal plant species in tribal communities, West and South Tripura, India**



**Fig. 2 Percentage distribution of ethno-botanical medicinal plant species across various life forms in the study area**

## Conclusion

Tripura is rich source of plants and tribes of Tripura are using them traditionally. Preservation of the indigenous knowledge of plants used in traditional health care is very important. Folk medicines were found to play important role in life of ethnic people. Aggressive civilization, rapid growth of industrialization and pollution are an important reason for the loss of different species and cause danger to biodiversity. Preservation of medicinal plants and investigation on different plants are necessary, which can give better drug/formulation with fewer side effects in treatment of various diseases. Many of the plants are still unexplored for its different medicinal values. Therefore, some plants were collected for screening their pharmacological activity to find out real therapeutic potential.

## Acknowledgement

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## Appendix 1. Traditional medicinal uses of plants used by the ethnic people of Tripura

Plant name	Family	Habit	Common name	Parts used	Diseases
<i>Abrus precatorius</i> L.	Papilionaceae	climber	sonakaich, takharichum	seed, leaves, root	joint, muscular and abdominal pain, poisonous bite
<i>Achyranthes aspera</i> L.	Amaranthaceae	herb	apang, samtai, ulta lengra	whole plant	kidney and urinary disorders, bleeding in time of delivery
<i>Adhatoda vasica</i> L.	Acanthaceae	shrub	basak, basakblai	leaf, aerial part	cough, cold, dysentery, fresh wounds
<i>Aegle marmelos</i> (L.) Corre	Rutaceae	tree	beel, belfang	fruit, leaf	asthma, diabetes, hepatitis, dysentery, indigestion, typhoid
<i>Ageratum conyzoides</i> L.	Asteraceae	herb	uchunti, dandotpali	leaf	menstruation pain and wound
<i>Albizia lebbeck</i> Benth.:	Mimosaceae	tree	sirish, kadai, khurai bufang	leaf, root, bark	skin disorder, asthma, diarrhoea, diseases of the gum
<i>Allium sativum</i> L.	Liliaceae	herb	rasun, risum	bulb	heart problem, skin disease, arthritis, colic pain, bronchitis
<i>Alocasia indica</i> L.	Araceae	herb	mann kachu, manai	tuber, leaf	rheumatism, habitual constipation
<i>Aloe indica</i> L	Liliaceae	herb	ghrita kumari, ghrita-kanchan	leaf	stomach diseases, hair fall and as cooling agent
<i>Alstonia scholaris</i> L.	Apocynacea	tree	chattim, chethuwang	bark	stomachic, expectorant, dental or gum problem
<i>Alternanthera philoxeroides</i> Griseb.	Amaranthaceae	herb	helencha, alancha	whole plant	stomach pain, diarrhoea
<i>Andrographis paniculata</i> Burm. f. Wall.	Acanthaceae	herb	kala megh, kalmegh balai	leaf	stomach problem, dysentery, worm infection, fever
<i>Aphanamixis polystachya</i> (Wall.)	Meliaceae	tree	pitra	bark, leaf	stomach pain, skin disease

## Continued Appendix 1

Plant name	Family	Habit	Common name	Parts used	Diseases
<i>Asparagus racemosus</i> Willd.	Liliaceae	climber	shatamuli	root, leaf	diarrhea, fever, measles, stomach pain
<i>Averrhoa carambola</i> L.	Averrhoaceae	tree	kamranga	fruit, leaf	arthritis, jaundice
<i>Azadirachta indica</i> A. Juss.	Meliaceae	tree	neem, ing	leaf, bark	leprosy, skin infections, chicken pox, diabetes, respiratory disorders
<i>Boerhaavia diffusa</i> L.	Nyctaginaceae	herb	punurnava, twisa jolap	root, leaf seed	asthma, urinary disorders, blood impurities
<i>Bombax ceiba</i> L.	Bombacaceae	tree	shimul, borchuk	root, leaf	head, tooth, ear and body pain, bone fracture
<i>Butea monosperma</i> (Lamk.) Taub.	Fabaceae	tree	palas	flower, bark	dysentery, toothache, wound
<i>Cajanus cajan</i> L.	<u>Fabaceae</u>	shrub	arhar, muimasing	leaf, flower, seed	fever, wound, inflammation
<i>Calotropis gigantea</i> L R Br.	Asclepiadaceae	shrub	akanda, angon	leaf, root, flower	fevers, cough, asthma, gum infection
<i>Cassia alata</i> L.	Caesalpiniaceae	shrub	dadmari, dangduraja	leaf	skin infection, ringworm infection
<i>Cassia fistula</i> L.	Caesalpiniaceae	tree	sonali, bandarlati, sundal	leaf, seed, bark	constipation, flatulence, inflammation, wounds
<i>Cassia occidentalis</i> L.	Caesalpiniaceae	under-shrub	kalkashunda, masinga	leaf, seed, root	constipation, urinary disorder, skin infection; cough
<i>Cassia tora</i> L	Caesalpiniaceae	herb	edanchi, lotho, chakunda	leaf, seed	worm infection, vision problem, liver disease, leprosy
<i>Catharanthus roseus</i> L.	Apocynaceae	under-shrub	nayantara, khumbaragi	leaf, root, flower	diabetic, insect bite, wound
<i>Centella asiatica</i> (L.) Urba	Apiaceae	herb	thankuni, masundwi	whole herb	stomach disorder, asthma, leprosy
<i>Cinnamomum tamala</i> (Buch. Ham.)	Lauraceae	tree	tejpata	leaf, bark	as stimulant, spice
<i>Cissus adnata</i> Roxb	Vitaceae	climber	bhaitya lata	root, leaf	bone fracture, pain
<i>Cissus quadrangularis</i> L	Vitaceae	climbing shrub	harbhanga	whole plant	bone fracture, indigestion
<i>Citrus lemon</i> (L.) Burm.	Rutaceae	shrub	kagaji lebu, lemu	fruit, leaf, root	hepatitis, vomiting, inflammation of tongue
<i>Clerodendrum indicum</i> L	Verbenaceae	shrub	brahma jasthi, asubahang	root, leaf	tooth decay, asthma, cough, rheumatism
<i>Clerodendrum viscosum</i> Vent.	Verbenaceae	shrub	bait gach, chayakkhui bufang, ghetu	root, leaf	inflammation, infection, skin disease, cough,
<i>Clitoria ternatea</i> L.	Fabaceae	climber	aparajita, khumalali	root, seed, leaf	constipation, mental disorder and as memory enhancer
<i>Coccinia grandis</i> L.	Cucurbitaceae	climber	telakuchi takhahaichumu	pata, whole plant	diabetes, scabies, skin infection
<i>Costus speciosus</i> (Koenig)	Costaceae	herb	keu, mailuma kothoma	root	inflammation, worm infection, constipation
Sm.					
<i>Crotalaria albida</i> Heyne ex Roth.	Papilionaceae	under-shrub	ban atasi, zhunzhuni, bishut	root, leaf	swelling of body, indigestion
<i>Curculigo orchoides</i> Gaertn.	Amaryllidaceae	herb	taal muli, kali mushli	root, leaf	piles and as sexual stimulant
<i>Curcuma aromatica</i> L.	Zingiberaceae	herb	ban halud, halk, lairu	rhizome	flatulence, skin infection
<i>Curcuma longa</i> L.	<u>Zingiberaceae</u>	herb	halud, swtwi	rhizome	jaundice, menstrual period problems, skin infection
<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	parasitic vine	sannalata	stem	cough, viral infection, itchy skin
<i>Cynodon dactylon</i> L.	Poaceae	herb	durba	whole plant	cough, dermatitis, painful menstruation
<i>Cyperus rotundus</i> L.	<u>Cyperaceae</u>	herb	mutha	leaf, bulb	urinary disorders, skin disease
<i>Datura stramonium</i> L.	Solanaceae	under-shrub	datura, dhatara	leaf, seeds	anxiety, rheumatism, body pain
<i>Dillenia indica</i> L.	Dilleniaceae	tree	chailta, thaiplok	fruit, leaf	fever, cough, wound
<i>Eichhornia crassipes</i> (Mart.) Solms	<u>Pontederiaceae</u>	herb	kachuripana, jarmafen	whole plant	cooling agent
<i>Euphorbia hirta</i> L	Euphorbiaceae	herb	dara dudhi, shyamkhai	leaf, stem, flower	skin disease, cough, pimples, gonorrhea
<i>Galinsoga parviflora</i> Cav	Asteraceae	herb	gangaful, garingburani sam	aerial part, leaf	fever, liver problem, wound, inflammation, insect bite, toothache
<i>Hedyotis auricularia</i> L	Rubiaceae	herb	multia lata, shyamkajal	leaf	abdominal disorder
<i>Hibiscus macrophyllus</i> Roxb.	<u>Malvaceae</u>	shrub	jabaful, lambak	leaf, flower	cough, sexual problems
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	shrub	rakta jaba, jaba ghum	leaf, flower	excessive hair loss, dandruff problems, menstruation problems
<i>Hibiscus schizopetalus</i> (Mast.) Hook. F.	Malvaceae	shrub	jumka joba	leaf, flower	fresh wound

## Continued Appendix 1

Plant name	Family	Habit	Common name	Parts used	Diseases
<i>Hippeastrum puniceum</i> (Lam.) Urb.	Amaryllidaceae	herb	kalaful	leaf	body swellings, skin infection
<i>Holarrhena antidysenterica</i> L.	Apocynaceae	shrub	kurchi, pandhra kuda, kuichama	root, bark	dysentery, fever, cold, piles
<i>Ichnocarpus frutescens</i> R.Br.	Apocynaceae	shrub	dugdha lata, perialata, flower, leaf soyalata	root, flower, leaf	bleeding in gum, skin disease, fever, kidney disease
<i>Ipomea aquatica</i> Forsk.	Convolvulaceae	vine/ climber	kalmi	whole plant	skin disease, dysentery
<i>Jasminum sambac</i> L.	Oleaceae	shrub	beli, komali	leaf, root, flower	wounds, headaches, insomnia
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	herb	patharkuchi	leaf	stomach disorder, wound, bleeding, fever, kidney stone, jaundice
<i>Jatropha curcas</i> L	Euphorbiaceae	shrub	ban verenda, keron	root, twig, leaf	skin diseases, rheumatism, in cleaning of teeth
<i>Leea asiatica</i> L.	Liliaceae	shrub	banchalita, koknal	root, leaf	worm infection, liver disorders, diabetes
<i>Leea indica</i> (Burm. F.) Merr.	Liliaceae	shrub	kukur jibba	root	stomach pain, diarrhoea
<i>Leucas lavandulaefolia</i> Rees	Labiatae	herb	halkusa, dondo kolos	root, stem, leaf	wound, skin infection, anxiety
<i>Litsea glutinosa</i> Lour.	Lauraceae	tree	kalimanda, kukurchita, ballsrap	bark, leaf	bone fracture, muscle pain and injury
<i>Mangifera indica</i> L.	Anacardiaceae	tree	aam, thaichuk	fruit, bark, leaf	jaundice, dental disease, dermatological disorder
<i>Marsilea minuta</i> L.	Marsaceae	herb	susni	whole plant	unsleeping condition, anxiety, dysentery
<i>Meriandra benghalensis</i> Cav.	Labiatae	herb	bangal sage	whole plant	high blood pressure, diabetes, skin disease; tonsillitis condition
<i>Meyna spinosa</i> Roxb.	Rubiaceae	tree	man kata, gaittara	fruit	skin disease, peptic ulcer, diabetes, hepatic disorder
<i>Michelia champaca</i> L.	Magnoliaceae	tree	chapa	bark, flower, fruit	skin disease, cough, arthritis
<i>Microcos paniculata</i> L.	Tiliaceae	shrub	pitchla, ashar bufang	leaf, fruit	bone fracture, cold, typhoid fever
<i>Mimosa pudica</i> L.	Mimosaceae	herb	lazzabati, samsunduru	root, leaf	leprosy, burning sensation, fever
<i>Mimusops elengi</i> L.	Sapotaceae	tree	bakul	seed, fruit, bark	fever, dental problem, tonsillitis
<i>Momordica charantia</i> L.	Cucurbitaceae	climber	karalla, ganla	whole plant, fruit, seeds	viral fever, diabetes, malaria, jaundice
<i>Moringa oleifera</i> Lam.	Moringaceae	tree	sedan, sajna	bark, fruit, roots, leaf	dental caries, toothache, urinary tract, throat infection
<i>Murraya paniculata</i> L.	Rutaceae	tree	kamini, kamini ghum	bark, root	tooth decay, swollen gums and as sexual stimulant
<i>Musa acuminate</i> L.	Musaceae	big herb	ram kala, thailik	fruit, leaf, flower	allergy infection, bronchitis, dysentery
<i>Nyctanthes arbortristis</i> L.	Oleaceae	tree	siuli, hengra	flower, leaf	bronchitis, asthma, inflammation, worm infection
<i>Ocimum sanctum</i> L.	Labiatae	shrub	tulsi, tulsirosom	leaf, seed	bronchitis, malaria, diarrhoea, dysentery, skin diseases
<i>Oxalis corniculata</i> L.	Oxalidaceae	herb	amlati, amchukai	whole plant	dysentery, stomach disorders, rheumatism, toothache
<i>Pandanus odoratissimus</i> Roxb.	Pandanaceae	large shrub	keora, ketaki	root	red urine disorder, poisonous bite
<i>Paederia foetida</i> L.	Rubiaceae	vine/ climber	gondhabadali, dukhupui	leaf, root, fruit	amoebiasis, tooth ach, stomach pain
<i>Phyllanthus acidus</i> L.	Euphorbiaceae	small tree	harbarai, leur, iheri	leaf, fruit	smallpox, stomach and liver disorders, rheumatism
<i>Phyllanthus emblica</i> L.	Euphorbiaceae	tree	amlaki	fruit	hair fall, diabetes, conjunctivitis, urinary problem
<i>Phyllanthus fraternus</i> Webster	Euphorbiaceae	herb	bhuiamlam, samuk gach	leaf, root	irregular menstrual cycle, diabetes, dysentery
<i>Piper longum</i> L.	Piperaceae	shrub	pepui, pipul	root, fruit	respiratory infections, pregnancy disorders, cough
<i>Plumeria acutifolia</i> L.	Apocynaceae	tree	kathgolap, golachibusan	bark, leaf, latex	dysentery, diarrhea, inflammation
<i>Plumeria rubra</i> L.	Apocynaceae	shrub	lal kathgolachi, golachi	leaf, flower	dysentery
<i>Psidium guajava</i> L.	Myrtaceae	tree	peyara, goyam	leaf, fruit	tooth pain and decay, abdominal pain, dysentery
<i>Piper nigrum</i> L.	Piperaceae	climber	gulmarich	root, fruit	cough, earache, stomach disorder
<i>Plumbago zeylanica</i> L.	Plumbaginaceae	herb	chitogachh, jaundicea	root, bark, seeds	jaundice, snakebite, digestive, to induce abortion
<i>Rauwolfia serpentina</i> L.	Euphorbiaceae	under shrub	sarpagandha, lairusich	root, leaf	hypertension, anxiety, bitter, snake bite
<i>Ricinus communis</i> L.	Euphorbiaceae	shrub	bheron, letok	seed, leaf	cough, asthma, toothaches, leprosy

## Continued Appendix 1

<i>Santalum album</i> L.	<u>Santalaceae</u>	tree	swet kufur	chandan, chandan wood, seed	urinary infection, skin infections, pimples
<i>Saraca indica</i> (Roxb.) Wilde	<u>Fabaceae</u>	tree	ashok, khumbaikang	bark, flower	menstruation pain, skin disease
<i>Sesamum indicum</i> L.	<u>Pedaliaceae</u>	herb	til, siping	leaf, seed	cholera, cough, skin infection
<i>Sesbania grandiflora</i> L.	<u>Fabaceae</u>	tree	bakful	bark, flower, leaf	cough, small pox
<i>Smilax zeylanica</i> L.	<u>Smilacaceae</u>	climber	komarialata, koyarma	root, leaf	hepatitis, urinary disease, skin disease
<i>Solanum melongena</i> L.	<u>Solanaceae</u>	herb	begun, fantok	fruit, root	inflammation, sores
<i>Spermacoce hispida</i> L.	<u>Rubiaceae</u>	climber	rifugilata	leaf	wound, blood disease
<i>Spondias pinnata</i> (L. f.) Kurz.	<u>Anacardiaceae</u>	tree	amra	bark, fruit, leaf	dysentery, skin disease
<i>Stephania japonica</i> (Thunb.) Mier	<u>Menispermaceae</u>	climber	aknadi, shyamhakkra	leaf, root	abdominal pain and flatulence, urinary disorder
<i>Streblus asper</i> Lour.	<u>Moraceae</u>	tree	sheora, saruya	stem, root, leaf	toothache, dysentery, hair loss and to maintain black colour of hair
<i>Tagetes erecta</i> L.	<u>Asteraceae</u>	herb	genda, sotrobonga	leaf	bleeding, wound, stomach ach, dysentery
<i>Terminalia arjuna</i> Roxb.	<u>Combretaceae</u>	tree	arjun, arjunfang	bark, leaf	stomach disorders, heart problem, earache
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	<u>Combretaceae</u>	tree	bhoera	fruit	stomach problem, cough
<i>Terminalia chebula</i> Retz.	<u>Combretaceae</u>	tree	bakhla, haritaki	fruit	cough, vomiting, stomach pain, diabetes
<i>Tinospora cordifolia</i> (Thunb.) Miers	<u>Menispermaceae</u>	climber	gulancha, duksa sungdari	whole plant	urinary disorders, arthritis, diabetes
<i>Typhonium trilobatum</i> Schott	<u>Araceae</u>	herb	khargan	leaf	bowl disease, constipation, body pain
<i>Vernonia cinerea</i> Less.	<u>Asteraceae</u>	herb	siyalmutra, debpari	root, leaf	abdominal pain, diarrhea, skin infection
<i>Vitex negundo</i> L.	<u>Verbenaceae</u>	shrub	nishinda	whole plant	weakness, joint pain, black fever, malaria, vomiting
<i>Xeromphis spinosa</i> (Thunb.)	<u>Rubiaceae</u>	shrub	mainaphal, monkata	leaf, fruit	inflammation, pain, vomiting
<i>Zingiber officinale</i> Roscoe	<u>Zingiberaceae</u>	herb	aada, haching	rhizome	nausea, asthma, loss of appetite, ear pain, rheumatism
<i>Ziziphus mauritiana</i> Lam.,	<u>Rhamnaceae</u>	tree	baroi, baray	fruit	constipation, tooth pain and as nutrients

## Appendix 2. Medicinal plants and their traditional mode of applications by the ethinic people of Tripura for the treatment of various aliments

Plant name	Aliment treated and traditional mode of application
<i>Abrus precatorius</i>	Decoction of <i>Abrus precatorius</i> leaves is taken orally to treat joint and muscular pain; seed paste is applied in place of poisonous bitted; fresh leaf or root juice is taken orally in abdominal pain.
<i>Achyranthes aspera</i>	Root paste mixed with hot water is given through oral route for curing kidney and urinary disorders; whole plant past is applied to reduce bleeding and topical inflammation.
<i>Adhatoda vasica</i>	Fresh leaf juice mixed with ginger and honey is useful for the treatment of cough; root extract is useful for dysentery; fresh green leaves or aerial parts of the plant are used as a poultice over fresh cuts to cure wounds.
<i>Aegle marmelos</i>	Unripe fruits are slightly roasted on fire, pulps are mixed with water and taken orally in morning to cure indigestion; pulp of ripe fruit is administered alone or after mixed with water to treat dysentery; leaf extract is taken with few drops of honey to cure typhoid; fresh juice of leaves is useful in diabetes.
<i>Ageratum conyzoides</i>	Crude leaf paste is used on wound to stop bleeding and heal the wound; the crushed fresh leaves are found useful to relieve pain in painful menstruation.
<i>Albizia lebbeck</i>	Leaf paste is applied on skin in skin disorders; Decoction from bark is used on asthmatic condition; root paste is used to relief pain in gum disease.
<i>Allium sativum</i>	Fresh bulbs are taken in empty stomach to cure colic pain and heart problems; bulb paste is applied topically to cure infected skin and also used as a common spice.
<i>Alocasia indica</i>	Juice of fresh leaves and tubers is used in rheumatism; food (curry) prepared with tuber and stem is used regularly to treat habitual constipation.
<i>Aloe indica</i>	The juicy portion of the fresh leaf is mixed with little amount of sugar and administered in stomach disease; fresh leaves are crushed and extracted juice is applied on scalp to reduce fair fall and it also confer cooling effect.
<i>Alstonia scholaris</i>	Fresh bark extract is useful in stomach disorder; latex is applied to cure gum problems; decoction from bark is used as expectorant.
<i>Alternanthera philoxeroides</i>	Juice from leaves and young shoots is taken daily to cure stomach pain and diarrhea; the whole plant is boiled and taken as vegetable to cure stomach problems.
<i>Andrographis paniculata</i>	Leaf juice is taken as stomachic; stems are kept in water overnight and next morning it was ground with water and taken to cure parasitic worm infection; pills are made from leaf paste and taken in fever.

**Continued Appendix 2**

Plant name	Aliment treated and traditional mode of application
<i>Aphanamixis polystachya</i>	Decoction from leaf is taken in stomach diseases; oil of this plant is useful in remedying for skin disorder
<i>Asparagus racemosus</i>	Leaf powder is taken orally in stomach problem and urinary disorders; The juice of the root is given in diarrhea.
<i>Averrhoa carambola</i>	Fruit is taken to stop vomiting; fruits and leaves are also used in jaundice.
<i>Azadirachta indica</i>	Leaf paste is applied topically in skin disorders; fresh leaves are kept in room and fried leaves are taken in chicken pox; Decoction from bark and leaf is taken in diabetes; young stems are used as tooth brush.
<i>Boerhaavia diffusa</i>	Leaf juice is taken with honey to remove blood impurities; root juice is taken daily in asthmatic condition; leaf juice is also useful in urinary disorder.
<i>Bombax ceiba</i>	Leaf paste and juice are useful to treat pain in rheumatism and tooth ach; the bark and leaf pastes are used as bandage in bone fracture.
<i>Butea monosperma</i>	Bark extract and latex are given orally in dysentery; flower paste and resin are applied on gum in tooth ach.
<i>Cajanus cajan</i>	Infusion of the leaves is used in fever; the paste of leaves is applied in fresh wound to stop bleeding and inflammation.
<i>Calotropis gigantea</i>	Latex of the plant is applied on gum to treat infection; flower with few drops of honey is taken in cough and asthma; leaf juice is used to treat fever.
<i>Cassia alata</i>	Leaf paste with coconut oil is applied topically on skin to treat ringworm and other infection.
<i>Cassia fistula</i>	Leaf juice is useful in constipation; leaf/bark paste is used topically in fresh wound to reduce inflammation; the fruits and seeds are soaked in water and then the water is administered orally to get relief from acidity
<i>Cassia occidentalis</i>	Leaf paste is applied topically in skin infection; leaf juice is useful in constipation; decoction of root is taken in urinary disorder; seeds are useful in cough.
<i>Cassia tora</i>	Juice of the leaf is useful in worm infection; leaf and seed paste is applied topically as poultice in skin diseases like leprosy; decoction from full pant is also used in vision disorder and as liver tonic.
<i>Catharanthus roseus</i>	Leaf juice is taken regularly in diabetes; the fresh leaves of the plant are crushed and applied on place of insect bite and fresh wound.
<i>Centella asiatica</i>	Fresh juice of the plant and boiled plant as vegetable is taken in stomach disorder and in indigestion; decoction of the plant is taken in asthma; plant is used to treat skin disorders.
<i>Cinnamomum tamala</i>	Leaves are used in different food preparation as a spice and stimulant.
<i>Cissus adnata</i>	Leaves are made into paste and applied on affected area to relieve pain and cure bone fracture.
<i>Cissus quadrangularis</i>	Fresh roots and leaves are pounded and made to paste, and poultice of that paste is applied to cure bone fracture and strengthen the bone; juice from stem also is administered in indigestion.
<i>Citrus lemon</i>	Decoction from roots and leaves is useful in curing hepatitis; smell of crushed leaves is taken to stop vomiting; juice of lemon is applied on tough to reduce inflammation
<i>Clerodendrum indicum</i>	Leaf paste is applied to cure wounds and to stop infection; juice from leaves with ginger juice (1:2) is taken on cough or asthmatic condition.
<i>Clerodendrum viscosum</i>	Dried roots are grounded, mixed with water and kept overnight, which is useful in fever; paste of the leaf/root is applied to cure skin infection and reduce inflammation.
<i>Clitoria ternatea</i>	Crushed roots are taken in constipation with water; seed and leaf are also useful as memory enhancer and in mental disorder.
<i>Coccinia grandis</i>	Leaf juice is taken orally in diabetes regularly and whole plant paste is applied topically in skin disorders; fruit and leaf are also used as vegetable.
<i>Costus speciosus</i>	Juice from root is administered in worm infection and habitual constipation; paste from fresh root is also applied topically to reduce inflammation.
<i>Crotalaria albida</i>	Leaf paste is taken orally to treat indigestion and infusion of the root is used to treat body swelling.
<i>Curculigo orchoides</i>	Paste of the root with honey is taken as sexual stimulant; leaf and stem extracts are used to treat piles.
<i>Curcuma aromatica</i>	Decoction of rhizome is taken in flatulence and paste of rhizome is applied externally to cure skin infection.
<i>Curcuma longa</i>	Rhizome paste is applied externally to cure skin infection; juice of the rhizome is taken in jaundice and menstrual period problems
<i>Cuscuta reflexa</i>	Paste is applied on scalp to reduce itchiness; juice of the stem is taken in jaundice and cough.
<i>Cynodon dactylon</i>	Plant juice with honey is given in morning to reduce cough; leaf juice is also taken in dysmenorrhoea.
<i>Cyperus rotundus</i>	Juice from the root is used to treat urinary complications; root and leaves are mixed, grounded and made into paste to apply externally for skin disorders.
<i>Datura stramonium</i>	Seed and flower paste is applied externally in rheumatism; dried leaf is used to smoke to get relief from anxiety; seeds and fresh leaves are also used to reduce body pain.
<i>Dillenia indica</i>	Juice of fruit is taken in fever and cold; decoction from leaf is used to treat urinary problems; leaf paste is applied to treat wound, pain and inflammation.
<i>Eichhornia crassipes</i>	Juice of the plant is used as cooling agent
<i>Euphorbia hirta</i>	Whole plant juice with milk is taken in gonorrhea; latex of the plant is applied on pimples; leaf power with mustered oil is applied externally in skin diseases; leaf juice is taken to reduce cough.
<i>Galinsoga parviflora</i>	Flowers are rubbed in teeth to get relieve from tooth ach; leaf juice is used in fresh wound to stop bleeding and in insect bite as antidote; decoction of the plant is taken in liver problem.

**Continued Appendix 2**

Plant name	Aliment treated and traditional mode of application
<i>Hedyotis auricularia</i>	Leaf juice is given in different abdominal disorders.
<i>Hibiscus macrophyllus</i>	Leaf extract is administered to reduce cough; flower extract is administered in different sexual problem.
<i>Hibiscus rosa-sinensis</i>	Young flowers are taken in irregular menstruation problem; flowers and leaves are made into paste and applied on hair in dandruff problem.
<i>Hibiscus schizopetalus</i>	Juice from fresh leaves is applied on fresh wound to stop bleeding.
<i>Hippeastrum puniceum</i>	Leaf paste is applied externally in tissue swelling due to infection.
<i>Holarrhena anti-dysenterica</i>	Decoction of bark is used in dysentery and piles; seeds are used in the treatment of fever and cold.
<i>Ichnocarpus frutescens</i>	Decoction from root is given in fever; leaf is made in paste using coconut oil and paste is applied on skin disease; root juice is used to treat kidney disorders; flowers with paper are made into paste and applied in gum in gum disease.
<i>Ipomea aquatica</i>	Plant is pounded and juice is drunk to cure dysentery; young shoots are used as vegetable in dysenteric condition.
<i>Jasminum sambac</i>	Paste of young leaves is applied on wound; paste from root is applied on forehead to reduce headache; flowers are given in insomnia.
<i>Jatropha curcas</i>	Twigs of the plant are used as brush for cleaning the teeth; leaf paste is applied in skin diseases like scabies and eczema; seed oil is used in arthritis.
<i>Kalanchoe pinnata</i>	Crushed leaf is kept on wound/injury to stop bleeding; fresh juice of the leaf is taken in early morning in dysenteric condition and kidney stone; leaf juice with black paper is useful for the fever; leaf of the plant is also given in jaundice.
<i>Lantana camara</i>	Paste of the leaf and flower is applied externally in arthritis.
<i>Leea asiatica</i>	Paste of root is taken as anthelmintic; leaf juice is taken in liver disorders; decoction from plant is used in heart disorders; leaves are kept with water overnight and next morning water is given to diabetic patient orally.
<i>Leea indica</i>	Decoction of root is useful in stomach pain and diarrhea.
<i>Leucas lavandulaefolia</i>	Stem and leaf paste is applied in wound and skin infection; root extract is useful in anxiety.
<i>Litsea glutinosa</i>	Leaves of the plant are pounded and paste is applied to cure bone fracture, muscle pain, injury and inflammation.
<i>Mangifera indica</i>	Root paste is useful in jaundice and skin disorder; young stems are used as tooth brush; fruits are used as food.
<i>Marsilea minuta</i>	Fresh leaves crushed with cold milk are used in unsleeping condition; juice of the plant is used in fever and dysentery.
<i>Meriandra benghalensis</i>	Paste of the plant leaves mixed with cow urine is applied on skin disease; juice of the plant is taken in diabetes and also useful in high blood pressure; decoction of the plant is taken in tonsillitis condition.
<i>Meyna spinosa</i>	Leaf paste mixed with turmeric is rubbed on infected area; ripe fruit extract is taken in hepatic disorder; leaf extract is useful in peptic ulceration; fruits and leaf juice is useful in diabetes.
<i>Michelia champaca</i>	Leaf extracts with coconut oil are applied on affected joints in rheumatism; decoction of bark is used in the treatment of cough; grounded flower is applied in skin disease.
<i>Microcos paniculata</i>	Leaf juice is used in typhoid fever; bark paste is also used in bone fracture.
<i>Murraya paniculata</i>	Root juice is used as sexual stimulant.
<i>Musa acuminate</i>	Flower extract is used in bronchitis; flower juice is used in allergic reaction; inside core of the plant is used in dysentery and taken as vegetable. Fruit is good source of nutritional value.
<i>Nyctanthes arbortristis</i>	Leaves are blend into a paste using mustered oil and applied in worm infection externally; flowers are crushed and applied to reduce inflammation; juice extracted from aerial part is used in asthma and bronchitis.
<i>Ocimum sanctum</i>	Fresh juice of the leaves is taken in diarrhoea and dysentery; fresh leaves are taken in early morning in empty stomach to get relief from bronchitis; plant paste is used in skin infection.
<i>Oxalis corniculata</i>	Whole plant juice is taken in dysentery, stomach disorders; paste is applied to reduce toothache; plant is also used to treat rheumatism.
<i>Pandanus odoratissimus</i>	Root paste is applied topically in poisonous bite as antidote; roots of the plant and turmeric rhizome are grounded equally, and made into paste to treat red urine disorder.
<i>Mimosa pudica</i>	Leaves are made into paste and applied as bandage in leprosy; leaf juice is useful in fever; extract from root and leaf mixed with equal portion is taken in burning sensation.
<i>Mimusops elengi</i>	Juice from seeds and barks grounded is used as gargle in tonalities; bark paste is applied on dental infection; fruit juice is taken in cough.
<i>Momordica charantia</i>	Fruit juice is taken as a treatment of viral fever and malaria; leaf juice is taken regularly in diabetes; decoction of plant is also useful in jaundice; biold fruit is taken in those disease condition.
<i>Moringa oleifera</i>	Bark paste is applied in toothache and used to clean the teeth; juice of leaf is useful in urinary tract infection; leaf extract with mix with honey is applied in throat in infection; fruits are taken as vegetable.
<i>Paederia foetida</i>	Leaf juice is taken in amoebiasis and stomach pain; powder of plant is applied in toothache.
<i>Phyllanthus acidus</i>	Juice of the fruit is taken in stomach and liver disorders; leaf paste is used in small pox; plant paste with coconut oil is applied in rheumatism.
<i>Phyllanthus emblica</i>	Fruits are made into paste and applied in hair to reduce hair fall; fruits are grinded to extract a tablespoon juice, which is heated and applied in eye in conductivities; leaf and fruit paste is useful to reduce burning sensation in urinary tract; fruit is useful in diabetes.

**Continued Appendix 2**

Plant name	Aliment treated and traditional mode of application
<i>Phyllanthus fraternus</i>	Fruits are taken in diabetes; juice of the leaf is taken in irregular menstrual cycle; decoction of the leaf is useful in dysentery.
<i>Piper longum</i>	Fruits are ground and made into powder mix with honey to treat respiratory infection and cough; root juice is used in pregnancy disorders.
<i>Piper nigrum</i>	Dry fruit and seed powder is used in cough; decoction of leaf is used in stomach disorders; paste of the fruit and leaf is applied externally to reduce earache.
<i>Plumbago zeylanica</i>	Bark extract is administered in jaundice; root is used to induce abortion; seed extract is used as digestive; bark paste is used as antidote in snake bite.
<i>Plumeria acutifolia</i>	Bark decoction is used in amoebic dysentery; leaf juice and latex is used in wound to reduce inflammation.
<i>Plumeria rubra</i>	Decoction from bark is used in amoebic dysentery.
<i>Psidium guajava</i>	Juice of young leaf or raw leaf is taken in empty stomach to reduce abdominal pain and dysentery; paste of the leaf is applied in gum to reduce tooth pain.
<i>Rauwolfia serpentina</i>	Decoction from root is taken to reduce hypertension and anxiety; root is used by local tribal medicinal people in snake bite; leaf is used to increase appetite.
<i>Ricinus communis</i>	Leaves and seeds are crushed and applied topically over wound to treat leprosy; seed extract is used in cough and asthma; leaf paste is used to reduce asthma.
<i>Santalum album</i>	Leaf paste is used externally in skin infection; semisolid paste from wood is used as cosmetic to remove pimples.
<i>Saraca indica</i>	Decoction from bark is used in menstruation pain; paste of the bark is useful in skin disease.
<i>Sesamum indicum</i>	Leaf extract is useful in cholera; seeds are edible and oil from seed is used in skin infection; leaf is useful to reduce cough.
<i>Sesbania grandiflora</i>	Flowers are edible; leaf extracts are useful in cough; bark paste is used in the treatment of small pox.
<i>Smilax zeylanica</i>	Leaf juice is used in hepatitis; paste of the leaf is useful in skin disease; decoction of root is used in the treatment of urinary disease.
<i>Solanum melongena</i>	Fruits are used as common vegetable; decoction of root is used to treat inflammatory condition and in sore.
<i>Spondias pinnata</i>	Bark and leaf are applied topically in skin infection; fruits are used to treat dysentery.
<i>Stephania japonica</i>	Juice of the leaf is used to treat urinary disorder; infusion of root is useful in abdominal pain and flatulence.
<i>Streblus asper</i>	Stem extract is used in dysentery; root paste is rubbed into gum to reduce tooth ach; leaf paste is useful to reduce hair loss and to maintain black colour of hair.
<i>Tagetes erecta</i>	Fresh leaves are crushed into hand and applied on wound as an antiseptic to stop bleeding; juice of the leaf is used to cure stomach ach and dysentery.
<i>Terminalia arjuna</i>	Decoction of bark is taken in early morning in heart problem; leaf paste is used externally to reduce earache; infusion of bark is also used occasionally in stomach disorders.
<i>Terminalia bellirica</i>	Juice of fruit and raw fruit is taken to reduce cough and stomach problem.
<i>Terminalia chebula</i>	Powder of the fruit with honey is used to reduce vomiting; dried fruit is kept in water overnight and early morning the water is taken in cough and asthmatic condition; paste of the fruit is used in stomach pain.
<i>Tinospora cordifolia</i>	Whole plant is boiled in water and taken to cure urinary disorders; whole plant is crushed and used in the treatment of arthritis; leaf decoction is used in the treatment of diabetes.
<i>Typhonium trilobatum</i>	Leaves are used as vegetable and given to reduce body pain and in bowl disease; juice of the leaf is given in constipation.
<i>Vernonia cinerea</i>	Decoction of plant is used in the treatment of abdominal pain and diarrhea; leaf paste is used to reduce skin infection.
<i>Vitex negundo</i>	Leaf infusion is administered in the treatment of black fever and malaria; crushed leaf is mixed with coconut oil and warm gently to make into paste, which is applied topically to reduce pain and muscle weakness; leaf is boiled with water and taken to reduce vomiting.
<i>Xeromphis spinosa</i>	Leaf paste is used in the treatment of inflammation and pain; fruits are taken to stop vomiting.
<i>Zingiber officinale</i>	Fresh juice of the rhizome is used in case of loss of appetite and nausea; decoction of rhizome is used in asthma; juice of rhizome with honey is used to reduce ear pain; rhizome paste mixed salt is applied in rheumatism.
<i>Ziziphus mauritiana</i>	Infusion of leaf is used in constipation, tooth pain; fruits are taken popularly as nutrients.